SGM4562Q
Automotive, 4-Bit Bidirectional Voltage-Level Translator with Automatic Direction Sensing

GENERAL DESCRIPTION

The SGM4562Q is a 4-bit, non-inverting, bidirectional voltage-level translator which features two independent configurable power supply lines. The A and B ports track the V_{CCA} supply and V_{CCB} supply respectively. The supply voltage range is 1.2V to 3.6V for A ports and 1.65V to 5.5V for B ports. The device provides a bidirectional translation function among different voltage nodes (including 1.2V, 1.5V, 1.8V, 2.5V, 3.3V and 5V).

The SGM4562Q has an output-enabled (OE) function, which controls the outputs states. When OE goes low, all outputs enter into the high-impedance state. The OE should be connected to GND via a pull-down resistor, and the minimum resistor value depends on the current source capability of the driver.

The device is AEC-Q100 qualified (Automotive Electronics Council (AEC) standard Q100 Grade 1) and it is suitable for automotive applications.

The SGM4562Q is available in Green TSSOP-14, UTQFN-1.7×2-12L, TQFN-2.5×3-14L and TQFN-3.5×3.5-14AL packages. It operates over an ambient temperature range of -40℃ to +125℃.

FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
  Device Temperature Grade 1
  T_A = -40℃ to +125℃
- **Power Supply Voltage Ranges (V_{CCA} ≤ V_{CCB})**
  - **A Ports: 1.2V to 3.6V**
  - **B Ports: 1.65V to 5.5V**
- **Support V_{CCA} or V_{CCB} Isolation**
  - **When V_{CCA} or V_{CCB} is Low, Device Enters Power-Down Mode**
- **OE Input Tracks the V_{CCA} Supply**
- **Low Power Consumption**
- **Support Partial-Power-Down Function**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green TSSOP-14, UTQFN-1.7×2-12L, TQFN-2.5×3-14L and TQFN-3.5×3.5-14AL Packages**

APPLICATIONS

Automotive Applications
Industrial Equipment
Smartphones
Portable Equipment
Medical Equipment

TYPICAL APPLICATION

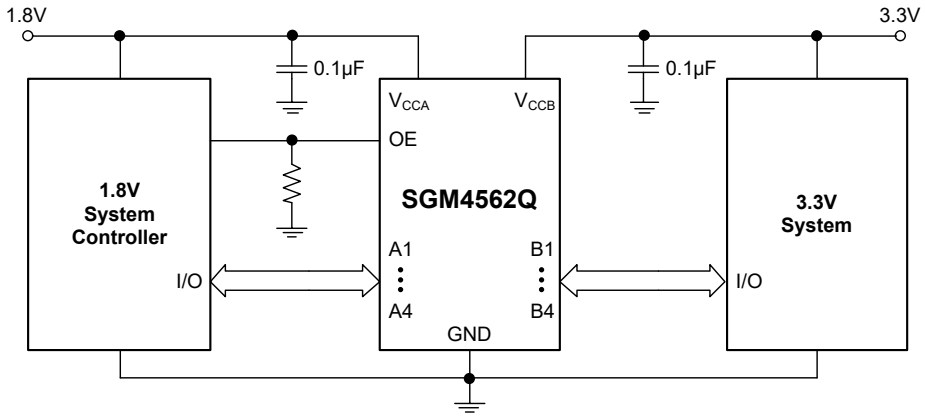


Figure 1. Typical Application Circuit

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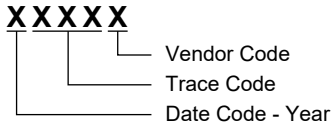
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE TOP MARKING	PACKING OPTION
SGM4562Q	TSSOP-14	-40℃ to +125℃	SGM4562QTS14G/TR	1MX TS14 XXXXX	Tape and Reel, 4000
	UTQFN-1.7×2-12L	-40℃ to +125℃	SGM4562QURF12G/TR	1FV XXXYY	Tape and Reel, 3000
	TQFN-2.5×3-14L	-40℃ to +125℃	SGM4562QTWB14G/TR	20UWB XXXXX XX#XX	Tape and Reel, 3000
	TQFN-3.5×3.5-14AL	-40℃ to +125℃	SGM4562QTSZ14G/TR	28DTSZ XXXXX XX#XX	Tape and Reel, 4000

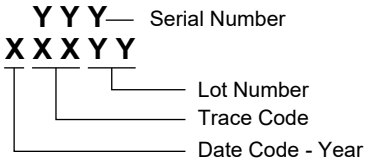
MARKING INFORMATION

NOTE: XXX = Date Code and Trace Code. XXXXX = Date Code, Trace Code and Vendor Code. XX#XX = Coordinate Information and Wafer ID Number.

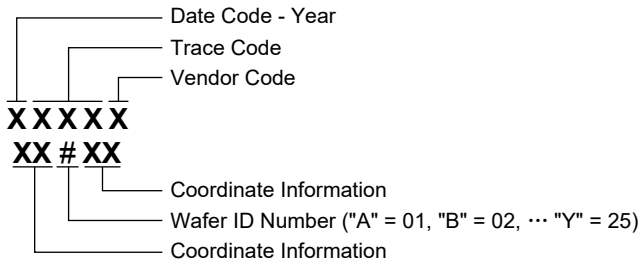
TSSOP-14



UTQFN-1.7×2-12L



TQFN-2.5×3-14L/TQFN-3.5×3.5-14AL



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage Range
- V_{CCA} ..... -0.5V to 4.6V
- V_{CCB} ..... -0.5V to 6.0V

Input Voltage Range, V_I
- A Ports ..... -0.5V to 4.6V
- B Ports ..... -0.5V to 6.0V

Output Voltage Range for the High-Impedance or Power-Down State, V_O
- A Ports ..... -0.5V to 4.6V
- B Ports ..... -0.5V to 6.0V

Output Voltage Range for the High or Low State, V_O (1)
- A Ports ..... -0.5V to V_{CCA} + 0.5V
- B Ports ..... -0.5V to V_{CCB} + 0.5V

Input Clamp Current, I_{IK} (V_I < 0) ..... -50mA (MAX)

Output Clamp Current, I_{OK} (V_O < 0) ..... -50mA (MAX)

Continuous Output Current, I_O ..... -50mA to 50mA

Continuous Current through V_{CCA}, V_{CCB}, or GND ..... -100mA to 100mA

Package Thermal Resistance
- TSSOP-14, θ_{JA} ..... 131.2℃/W
- TSSOP-14, θ_{JB} ..... 91.4℃/W
- TSSOP-14, θ_{JC} ..... 60.9℃/W
- UTQFN-1.7×2-12L, θ_{JA} ..... 135.1℃/W
- UTQFN-1.7×2-12L, θ_{JB} ..... 56.6℃/W
- UTQFN-1.7×2-12L, θ_{JC} ..... 80.2℃/W
- TQFN-2.5×3-14L, θ_{JA} ..... 55.7℃/W
- TQFN-2.5×3-14L, θ_{JB} ..... 26.4℃/W
- TQFN-2.5×3-14L, $\theta_{JC\ (TOP)}$ ..... 59.8℃/W
- TQFN-2.5×3-14L, $\theta_{JC\ (BOT)}$ ..... 10.6℃/W
- TQFN-3.5×3.5-14AL, θ_{JA} ..... 47℃/W
- TQFN-3.5×3.5-14AL, θ_{JB} ..... 21.5℃/W
- TQFN-3.5×3.5-14AL, $\theta_{JC\ (TOP)}$ ..... 45℃/W
- TQFN-3.5×3.5-14AL, $\theta_{JC\ (BOT)}$ ..... 11℃/W

Junction Temperature ..... +150℃

Storage Temperature Range ..... -65℃ to +150℃

Lead Temperature (Soldering, 10s) ..... +260℃

ESD Susceptibility (2) (3)

HBM ..... ±7000V

CDM ..... ±1000V

NOTES:

1. V_{CCA} and V_{CCB} values are shown in the Recommended Operating Conditions table.
2. For human body model (HBM), all pins comply with AEC-Q100-002 specification.
3. For charged device model (CDM), all pins comply with AEC-Q100-011 specification.

RECOMMENDED OPERATING CONDITIONS (4) (5)

Supply Voltage Range
- V_{CCA} ..... 1.2V to 3.6V
- V_{CCB} ..... 1.65V to 5.5V

High-Level Input Voltage, V_{IH}
- Data Inputs (V_{CCA} = 1.2V to 3.6V, V_{CCB} = 1.65V to 5.5V) ..... V_{CCI} × 0.65 (6) to V_{CCI}
- OE Input (V_{CCA} = 1.2V to 3.6V, V_{CCB} = 1.65V to 5.5V) ..... V_{CCA} × 0.65 to 5.5V

Low-Level Input Voltage, V_{IL}
- Data Inputs (V_{CCA} = 1.2V to 3.6V, V_{CCB} = 1.65V to 5.5V) ..... 0V to V_{CCI} × 0.35 (6)
- OE Input (V_{CCA} = 1.2V to 3.6V, V_{CCB} = 1.65V to 5.5V) ..... 0V to V_{CCA} × 0.35

Output Voltage Range for the High-Impedance or Power-Down State, V_O
- A Ports ..... 0V to 3.6V
- B Ports ..... 0V to 5.5V

Input Transition Rise or Fall Rate, Δt/ΔV
- A Port Inputs (V_{CCA} = 1.2V to 3.6V, V_{CCB} = 1.65V to 5.5V) ..... 40ns/V (MAX)
- B Port Inputs (V_{CCA} = 1.2V to 3.6V, V_{CCB} = 1.65V to 5.5V) ..... 40ns/V (MAX)

Operating Temperature Range ..... -40℃ to +125℃

NOTES:

4. Ensure that the A side and B side of the unused data I/O pairs remain the same state, that is, both at V_{CCI} or both at GND.
5. Ensure that $V_{CCA} \le V_{CCB}$ and V_{CCA} must not exceed 3.6V.
6. V_{CCI} is the supply voltage associated with the input ports.

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

ESD SENSITIVITY CAUTION

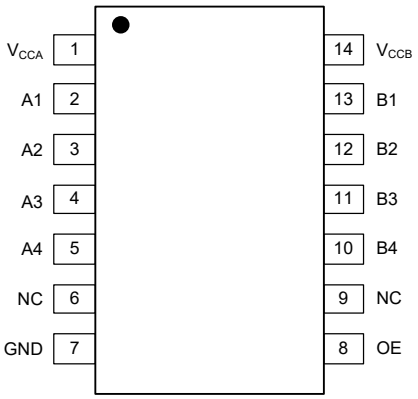
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

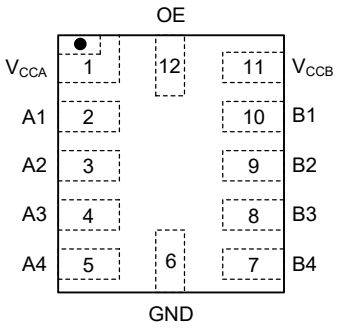
PIN CONFIGURATIONS

(TOP VIEW)



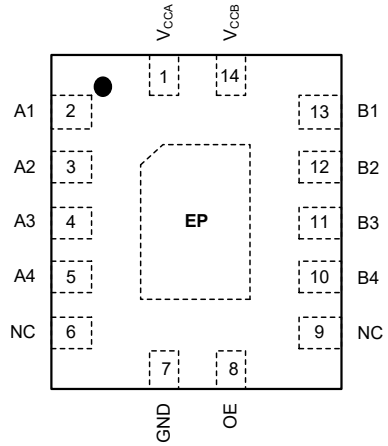
TSSOP-14

(TOP VIEW)



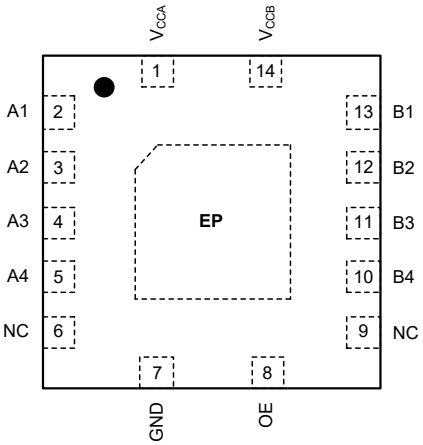
UTQFN-1.7×2-12L

(TOP VIEW)



TQFN-2.5×3-14L

(TOP VIEW)



TQFN-3.5×3.5-14AL

PIN DESCRIPTION

PIN				NAME	TYPE	FUNCTION
TSSOP-14	UTQFN-1.7×2-12L	TQFN-2.5×3-14L	TQFN-3.5×3.5-14AL			
1	1	1	1	V_{CCA}	P	Supply Voltage on A Ports. It can be operated from 1.2V to 3.6V.
2, 3, 4, 5	2, 3, 4, 5	2, 3, 4, 5	2, 3, 4, 5	A1, A2, A3, A4	I/O	Data Inputs/Outputs. These pins track the V_{CCA} supply.
6, 9	—	6, 9	6, 9	NC	—	No Connection.
7	6	7	7	GND	G	Ground.
8	12	8	8	OE	I	Output-Enabled Input. When OE goes low, all outputs enter into high-impedance state. It tracks the V_{CCA} supply.
10, 11, 12, 13	7, 8, 9, 10	10, 11, 12, 13	10, 11, 12, 13	B4, B3, B2, B1	I/O	Data Inputs/Outputs. These pins track the V_{CCB} supply.
14	11	14	14	V_{CCB}	P	Supply Voltage on B Ports. It can be operated from 1.65V to 5.5V.
—	—	Exposed Pad	Exposed Pad	EP	—	Exposed Pad. It can be connected to GND or be left floating.

NOTE: I = input, I/O = input/output, P = power, G = ground.

FUNCTIONAL BLOCK DIAGRAM

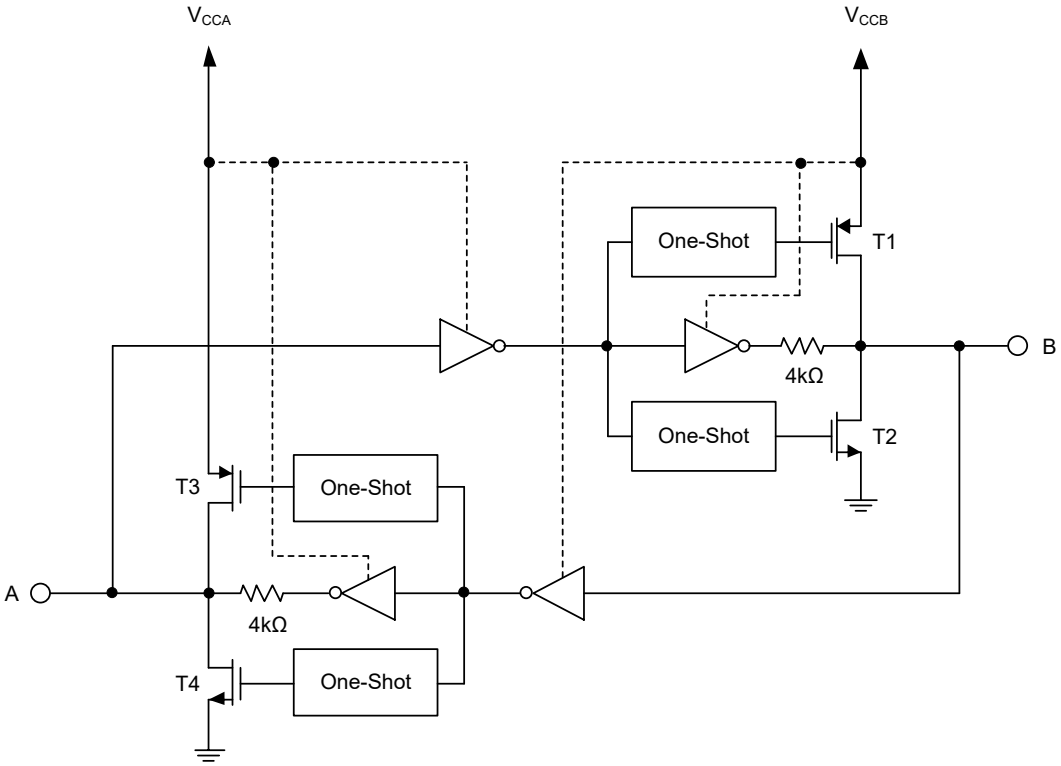
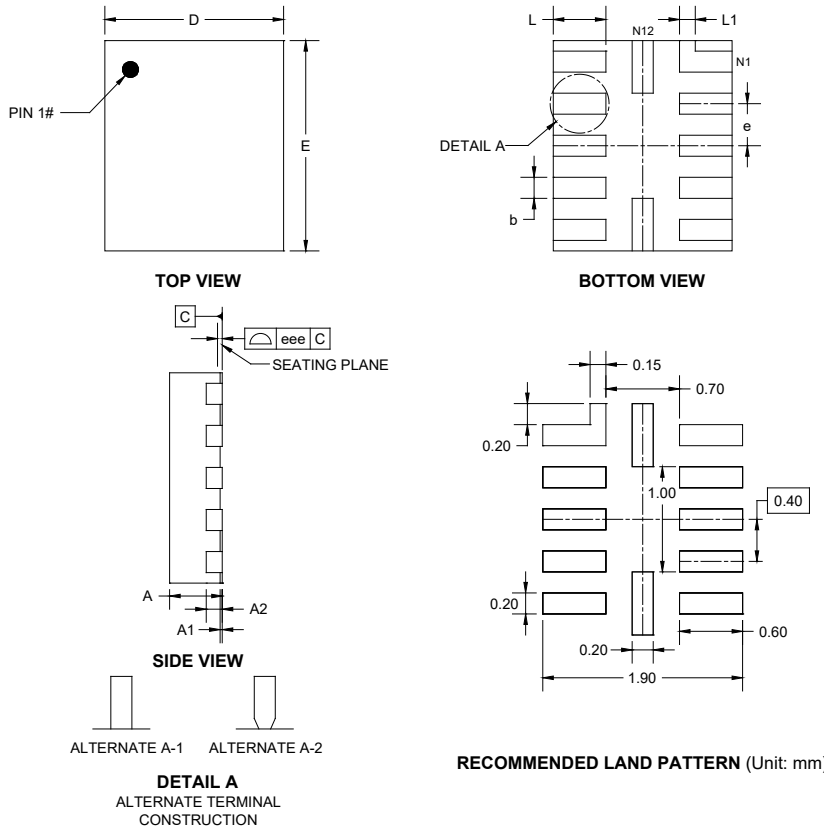


Figure 2. Architecture of SGM4562Q I/O Cell

PACKAGE OUTLINE DIMENSIONS

UTQFN-1.7×2-12L

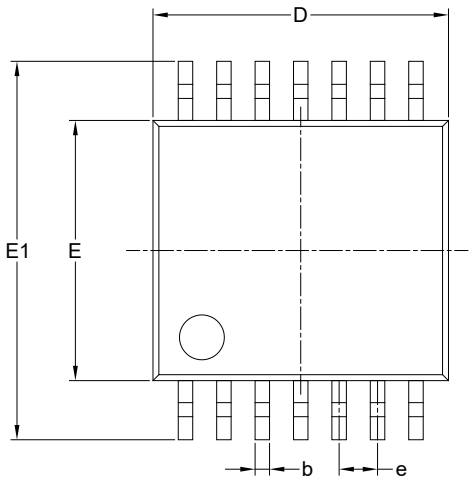


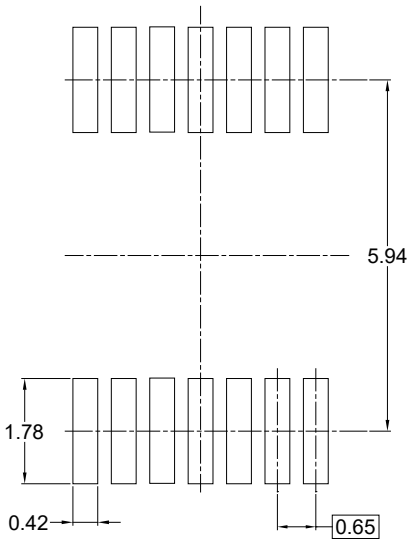
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.450	-	0.550
A1	0.000	-	0.050
A2		0.152 REF	
b	0.150	-	0.250
D	1.600	-	1.800
E	1.900	-	2.100
e		0.400 BSC	
L	0.450	-	0.550
L1		0.150 REF	
eee		0.080	

NOTE: This drawing is subject to change without notice.

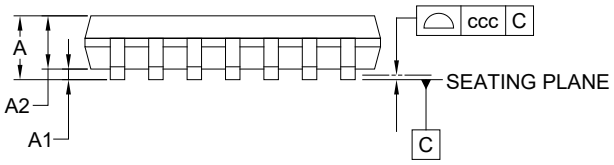
PACKAGE OUTLINE DIMENSIONS

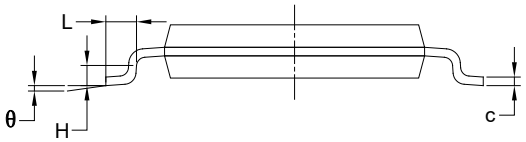
TSSOP-14





RECOMMENDED LAND PATTERN (Unit: mm)



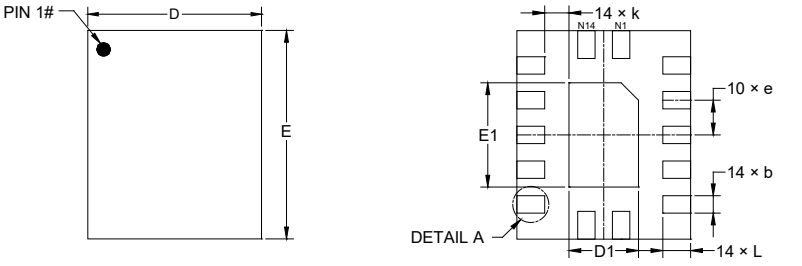


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	4.860	-	5.100
E	4.300	-	4.500
E1	6.200	-	6.600
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

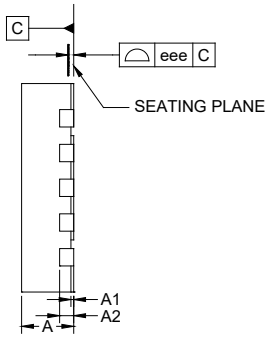
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-153.

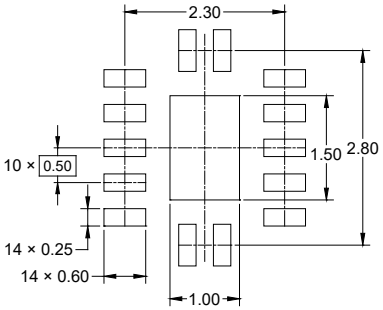
PACKAGE OUTLINE DIMENSIONS

TQFN-2.5×3-14L



TOP VIEW **BOTTOM VIEW**





SIDE VIEW **RECOMMENDED LAND PATTERN** (Unit: mm)



ALTERNATE A-1 ALTERNATE A-2

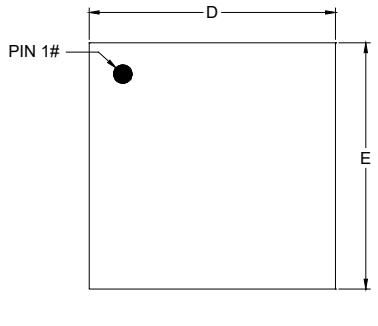
DETAIL A
ALTERNATE TERMINAL CONSTRUCTION

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.700	-	0.800
A1	0.000	-	0.050
A2		0.203 REF	
b	0.200	-	0.300
D	2.400	-	2.600
D1	0.900	-	1.100
E	2.900	-	3.100
E1	1.400	-	1.600
e		0.500 BSC	
k		0.350 REF	
L	0.300	-	0.500
eee		0.080	

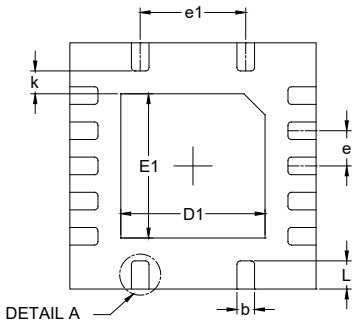
NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

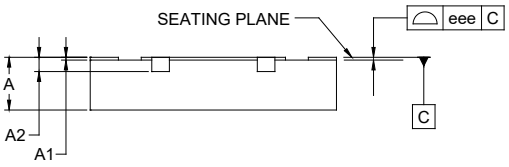
TQFN-3.5×3.5-14AL



TOP VIEW



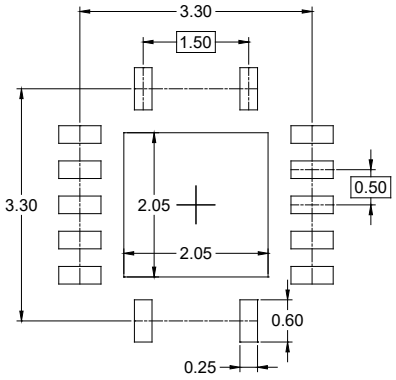
BOTTOM VIEW



SIDE VIEW



DETAIL A
ALTERNATE TERMINAL CONSTRUCTION



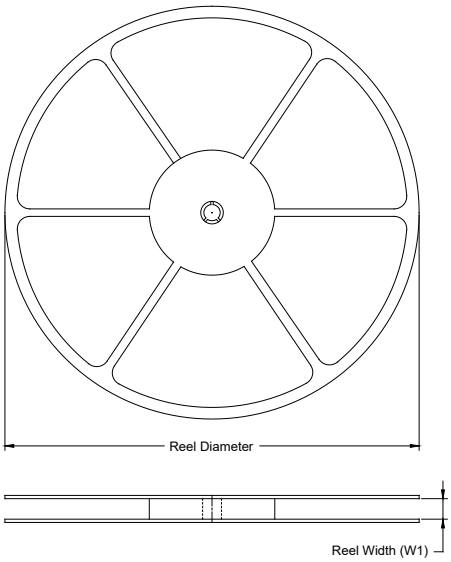
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.700	-	0.800
A1	0.000	-	0.050
A2	0.203 REF		
b	0.200	-	0.300
D	3.400	-	3.600
E	3.400	-	3.600
D1	1.950	-	2.150
E1	1.950	-	2.150
e	0.500 BSC		
e1	1.500 BSC		
k	0.200 MIN		
L	0.300	-	0.500
eee	0.080		

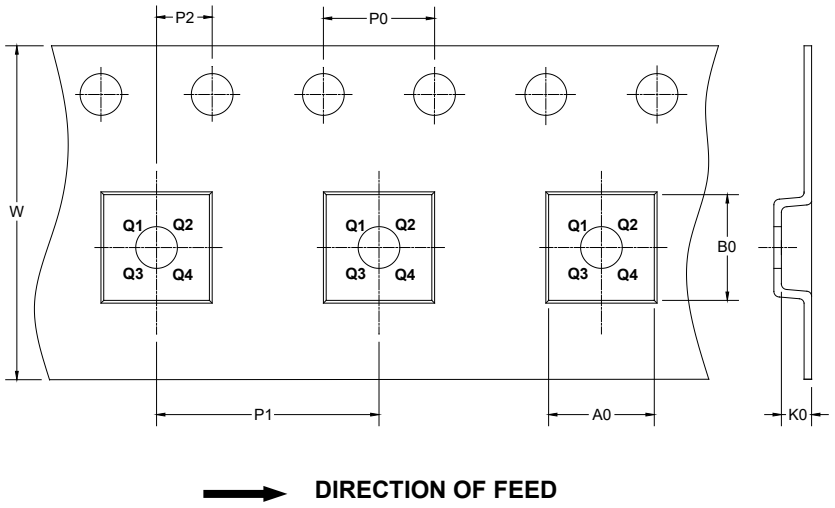
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



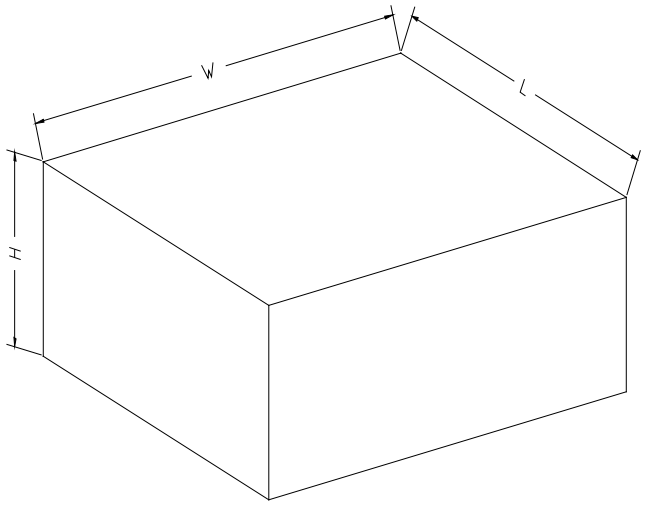
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
UTQFN-1.7×2-12L	7″	9.5	1.90	2.30	0.75	4.0	4.0	2.0	8.0	Q1
TSSOP-14	13″	12.4	6.80	5.40	1.50	4.0	8.0	2.0	12.0	Q1
TQFN-2.5×3-14L	13"	12.4	2.80	3.30	1.15	4.0	4.0	2.0	12.0	Q1
TQFN-3.5×3.5-14AL	13"	12.4	3.80	3.80	1.10	4.0	8.0	2.0	12.0	Q1

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18
13″	386	280	370	5

DD0002